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ABSTRACT

The four reports contained in this document examine the effects of the Nintendo Entertainment System (NES), which entered the lives of many children in the United States in 1986. The first report discusses a study of children's interaction with the game hardware. The study of fourth- and fifth-grade students indicated that children's interaction with the NES did not predict eye-hand coordination scores, laterality scores, or directionality scores. The second report focuses on an NES study that explored the complex thinking skills required for successful interaction with the system. The high school students in the study who played Nintendo scored higher on critical thinking skills tests than those students who did not play. The study indicated that children believe NES helps them think, and that they are transferring these thinking skills to other areas of life. The third report discusses a study involving fourth-, fifth-, and sixth-graders, and high school students. This study found that children do not think violent thoughts while playing, but think of strategy to win the game. The study also indicated that Nintendo playing activity decreases around the age span of 12 to 14. The fourth report examines why Nintendo is so appealing to children, some of the possible emotional, social, and educational benefits of NES interaction by children, as well as some possible harmful effects. Contains a total of 19 references. (TJQ)

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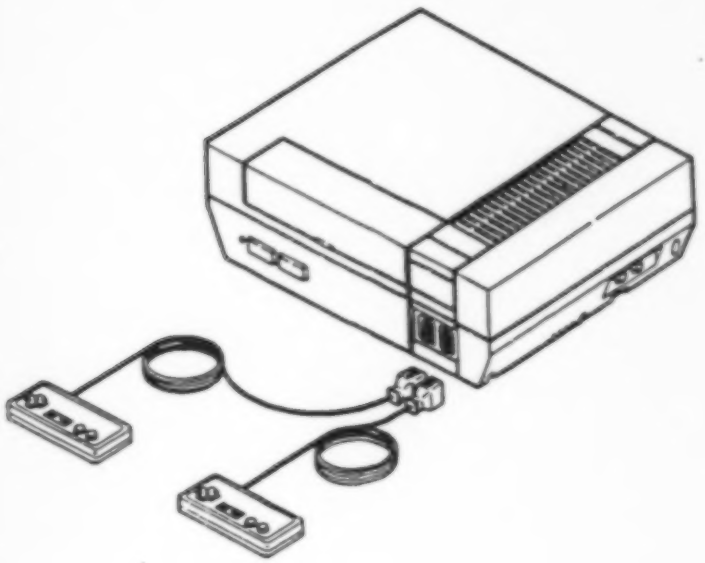
Children and the Nintendo



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Introduction

Video games were the most popular pastime of the 1980's, (Ferretti, 1986) and are well on the way to becoming the most popular pastime of the 1990's (Information Workstation, 1990). Ishigaki (1986) reports heavy usage in Japan, while Lent (1980) tells of the popularity of the games in Hong Kong, Malaysia, the Phillipines and Indonesia.

Research has been written exploring legal issues in regard to arcades, the social problems that accompany the playing of the games, academic concerns in regard to worth of the games, the ecomomic impact their popularity has caused, and other parental concerns that have arisen from children's association with the games. The Nintendo Entertainment System has eliminated many of these expressed concerns, because it is contained entirely in the home, attached to the television set.

Some studies have examined computer games, arcade games, and games on the Atari system. No studies, however, have been done using the Nintendo home entertaiment system. There are no studies which focus on the interaction of the child with the hardware of the game system as a basis for examination.

Reasoning Behind the Research

The thinking behind this research was that interaction with the control panel (hardware) would sharpen children's eye-hand coordination, their left-right orientation (laterality), and their sense of distinguishing left-right from another position (directionality). Girls' reaction time with the hands seems to be quick up until the age of ten, then, at

that time, boys' reaction time equals and surpasses the girls'. (Kilshaw & Annett, 1983) In addition, the arrangement of the manipulators on the control panel may have provided for an overall advantage in using one or the other hands. The manipulators are arranged in a left-right pattern. The gray cross, which gets the most use is located on the left side of the panel. The round buttons, which get second most use are located on the right side of the panel. Kilshaw & Annett (1983) indicated that left-handed people have a distinct advantage over right-handed people, in that they are more adept with both hands. With this information in mind, the variables of age, gender, and preferred hand were added.

How does this research relate to the academic world? Eye-hand coordination, laterality, and directionality, the skills that are being measured, are all essential skills in learning to read, write, spell, tell time, and read maps.(Lockavitch & Mauser, 1980)

Methodology

This study used a sample population of 127 fourth and fifth grade students from a small midwestern town in Illinois, whose ages ranged from 9-13. A questionnaire gained information in regard to age, gender, preferred hand, and the amount of time (self-reported) spent per week with the system. The Test for Visual-Motor Skills measured eye-hand coordination, and the LAD test measured lateral awareness and directionality.

Descriptive statistical procedures were used to answer the research questions, and three simple linear regression equations were used to answer the hypotheses.

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Research Questions

(1) Does the design of the control panel of the Nintendo home entertainment system influence play by either hand?
(2) Do more males play than females?
(3) Do males play for more hours than females?
(4) As age increases, do hours of play increase?

Hypotheses

(1) Nine, ten, eleven, and twelve year old children who are spending many hours per week playing with the Nintendo home entertainment system will have high scores on the Test of Visual Motor Skills, (TVMS) (Gardner, 1986) and high scores on both tests of the LAD (Lockavitch & Mauser, 1980). One section of the test measures lateral awareness and the other section measures di.ectionality.

(2) Nine, ten, eleven, and twelve year old children who are spending fewer hours with the Nintendo system will have lower scores on the TWMS, and both parts of the LAD.

Results

Question 1 The answer is "No." Left-handed players were playing slightly less than the right-handed players, so the control panel did not suggest an advantage for left or right handed players. **Left-handed players** were playing for an average of **14.08 hours per week**; **right-handed players** were playing for an average of **14.79 hours per week**; and **ambidexterous players** were playing for an average of **4.4 hours per week.**

Question 2 The answer is "Yes." Of the sample studied, **98%** of the **boys** were playing as compared to **92%** of the **girls.**

Question 3 The answer is "Yes." **Males** were playing an average of **17.3 hours** per week; **females** an average of **11.3 hours** per week.

Question 4 The answer is "Yes up to a certain age." As age increased, amount of playing increased from the **age of 9 up to the age of 11,** then it began to drop slightly.

Hypotheses

Hours of play did not predict scores (high or low) on the TVMS (eye-hand coordination), or the LAD test (which measures lateral awareness and directionality).

Therefore, children who spend many hours playing with the Nintendo system did not score high on the TVMS, or the tests for lateral awareness and directionality. Children who spend fewer hours playing with the Nintendo system did not score lower on those same tests.

Conclusion

This study indicates that, given this particular situation with this particular set of variables, children's interaction with the Nintendo system (as measured in hours per week) did not predict eye-hand coordination scores, laterality scores, or directionality scores (as measured by the TVMS and the LAD).

What about...

This study, by using hours of play as a predictor, assumed that children who played more

hours were more skillful players, and that children who played less hours were less skillful players. There are many reasons why children play or don't play. There are also many explanations for the length of time they spend, or do not spend, playing with the system. Being skilled as a result of longer play was just one assumption.

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The Nintendo Generation

The Nintendo Entertainment System (NES) entered the lives of many children, in the United States, in 1986. Sales, by 1990 had topped the 30 million mark. No other product in history has penetrated the market with such force. Parents, educators, and consumers look upon this new pastime with great anxiety. What effect is this game having upon the children of the 80s and 90s?

Motivation Behind the Research

As the mother of three children, and an educator, my interest had been

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aroused by video games in the early 80s. Hovewer, my interest peaked with the exploration of the NES in 1988. All video games require physical and mental interactivity, or they end. Interactivity is the key word, as the level and combination of physical and mental activity is astounding. Even more astounding are the sophisticated movements required by the buttons on the control panel of the NES. The skill necessary to manipulate these buttons is much greater than the skill necessary to maneuver a joystick which only call for a jamming of the joystick in any one of four directions. This level and combination of physical and mental activity sets this system far, far afield of any other sport, game or pastime. Because the television set is usually used for display of the game, I like to compare television viewing and playing Nintendo. TV viewing may stimulate thinking, but it does not require critical thinking and physical action and reaction to continue.

The Research

I decided to explore the hardware of this system, or interacting with the control panel, for my dissertation, in 1989-90. I used 9-12 year old children, and investigated the idea that eye-hand coordination, lateral awareness, and directionality skills would be strengthened by increased hours of play. Three simple linear regression equations were used with hours of play and each of the three test scores, eye-hand coordination, lateral awareness, and directionality. No significant difference was found in any of the equations, although the eye-hand coordination result was very close.

Why did it fail?

Students scored above the 90th percentile on all tests. The tests used to measure the above mentioned skills had been validated with children who had never been exposed to the NES. The other variable, hours of play, does not necessarily indicate level of skill. So, I had a great idea, but was stymied as to how to explore it further.

Second Study

I kept thinking, and decided to move to the software (games) that can be used with this system. I embarked upon a second study in 1991. I wanted to explore the complex thinking skills that successful interaction with this system requires. I observed role playing games, repetitive games, brain teasing games, adventure games, and other games that may not fit into any particular category. I watched at the arcades, grocery stores, and most importantly, at home. I tried to analyze skills common to the games. Many games require induction, starting with small bits of information and using that information to get farther along in the game; deduction, extracting information from what is already there, and using it to get farther in the

game; reflective thinking, in that the next time they may try a different way to solve a problem, because the previous attempt failed; application of what worked in one situation to another situation; hypothesizing of what will happen when they try a certain move; synthesizing of different strategies from different games; and evaluation, or judging the worth of different games, or even moves within the games.

I thought I could use the higher levels of Bloom's taxonomy in the cognitive domain to compare the thinking patterns, but I could not find an appropriate testing instrument. I finally found the Cornell Critical Thinking Test, and decided on Level X. This test seemed to focus a great deal on extracting skills from reading. So, did this mean that if scores were high, the students were also good readers, or did it mean that I had to worry if critical thinking skills could also be used in areas that didn't require reading? I decided that the skills measured were also used in playing Nintendo. The test measured induction, deduction, and evaluation, in general, and credibility, making assumptions, and using observations, more specifically.

The population

High school students have been exposed to video games and Nintendo for approximately eight years. I supposed that their level of critical thinking would be very high. There is a select group of students in the area where I conducted my research that is expected to refrain from TV viewing because of religious beliefs. So, I thought that they had never played Nintendo because it requires a TV set. Therefore, I had two groups of students, one group that played Nintendo, and one group that did not play, to use in the study.

235 high school students, between 14 and 18 years of age, from a high school in the Midwest were used. A questionnaire garnered information for playing/not playing, hours of play, hours of viewing TV, and many more interesting bits of information.

The results

Students in the group that had experience with the NES out-scored the students in the group that had no experience. Girls out-scored the boys in both groups.

Several variables were correlated. Playing Nintendo as opposed to not playing Nintendo was correlated with higher scores. More hours of playing Nintendo as opposed to less hours of play was correlated with higher scores. More hours of viewing TV was correlated with lower scores.

The scores on the Cornell Critical Thinking Test were:

	Do Not Play	Do Play
Entire test	34.367	36.411
Inductive	12.667	14.021
Deductive	11.500	12.105
Credibility	10.900	10.958
Assumptions	4.133	4.168
Observations	10.900	10.958

An independent T-test between the means was conducted and did not reveal enough difference to be significant.

Some qualitative results

- Most students started playing in 1988
- 80% of the 235 students play Nintendo
- The average time was 10 hours per week
- They like to play because it's fun, challenging, competetive, relaxing, gives them a sense of freedom, and they can escape reality.
- The favorite games were Super Mario 3, Super Mario 2, Mario Brothers, Dr. Mario; Tetris; the adventure games, Contra, Zelda, Top Gun 1and 2, and Link; and many sports games.
- They own 5 - 7 games
- Only 16% own a Game Boy
- They are involved in many other activities, such as sports, crafts, hunting, fishing, cheerleading, friends, dating, and pets.

- Some really do find time to read.

- They noticed improvement:

  Better comprehension
  Better reasoning
  Learning to think logically
  Can hit and catch a ball better
  Have more patience
  Grades are better
  Are able to make better and faster decisions
  Cheerleaders can do hand claps and snaps faster
  Builds confidence

- They noticed decline:

  Don't take time to eat
  Some have less patience
  Fight with Mom and siblings
  Don't study as much
  Don't read as much
  Don't do my chores

- The average G.P.A. was "B"

- 54% have their own TV set

- Some go through a variety of feelings before, during and after playing. Some are relieved and happy afterwards. Some are frustrated and mad

- The average TV viewing time was 17 hours per week. (Added with 10 Nintendo playing hours, it equals 27 hours of interaction with the TV)

- Besides their school books, they read comics, magazines, newspapers, romance novels, and Steven King books

- Some do not even read their school books

- They think Nintendo is not violent like TV; they are in control of

the Nintendo, they don't have to think with the television, and they get involved in the action with Nintendo.

- Parents major complaints are the cost, the noise, it ties up the TV, we should be outside, and we fight over it.

- Some parents love it, some like to play - with Dads really getting into the sports games and Duck Hunt.

- They think Nintendo can be used in school to improve memory, to think creatively, in typing faster, as a reward, to improve thinking, reasoning, and problem solving, and in P.E. for reflexes and sports.

- They see Nintendo continuing and improving for the future

Reaction to the research

This research is very much applied research. It certainly stimulates many people to think about what children are doing, and to give the Nintendo system some deep thought. The NES is a vehicle that helps children think. It appears that they are transferring these thinking skills into other areas of life. Learning theorists have been studying how people learn and how to improve the methods which are used to help people learn from the beginning of time. TV garnered a serious place in the learning field, and so did computers. I certainly think entertainment systems will earn their place as time passes.

Other concerns

There are many social and psychological concerns associated with interacting with this system. However, my general feelings, at this time, are that reasonable hours of play are not harmful, and indeed, are probably helpful. [In some of my other work, I talk about the social advantages, (It's definitely a conversation starter) and psychological advantages (building self esteem, and acquiring a sense of control and freedom) that playing may bring.]

In the future

I am still, to this very day, fascinated with the cognitive and psychomotor skills necessary to play with this system, even more so since the release of the Super Nintendo this past Christmas season. In addition to the cross, function

ellipses, and original round buttons, there are an additional two round buttons, more function ellipses, and two longer elliptical shaped panels on the top sides. It appears that even more skill is required to be successful.

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THE NINTENDO GENERATION II

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Besides clothing style, new slang words, and alternative music, what else is different about today's children? How great a role has technology played in making these children different from those of yesteryear? What are children doing in their leisure time?

Children have been watching television since the 50s, listening to recorded music since the 20s, and talking on the telephone since its inception in the late 1800s. So, what's so different about today's youth? In addition to having their ears glued to headsets from tape players, and their eyes glued to television sets, they now have their hands glued to the control panels of home entertainment systems. What are these video systems/games doing to our children?

I have pursued the answer to this question since 1988. I have conducted three studies in an attempt to explore what effects interacting with home entertainment systems may have on children. In the first attempt, I figured that to be successful in playing, children first had to know how to operate the control panel. I decided to pursue what skills it took to make the control panel work, which in turn, would make the figure or object successful on the screen. The control panel has a cross, two round buttons, and two elliptical buttons. Children must move the cross, and often times the round buttons in conjunction with the cross to make it work. I figured that a mystery skill (eye perceptions, carried out by the hands, without the eyes watching the hand) was needed. The skill most similar to this mystery skill was eye-hand coordination. In addition, lateral awareness and directionality were also required. Lateral awareness is an awareness of left and right, and depth perception. Children have a hard time distinguishing the left and right, especially the sides of another person, and, in particular, when the other person is facing them. Likewise, children know length and width, but are unaware of depth (or a third dimension) until about the age of 9 or 10. Directionality is realizing that certain directions don't change. For example, north is always north, no matter which way the child may turn, and clockwise is always clockwise. The character on the screen is able to move up, down, left, right, forward and backward, so the child must be able to understand which way to manipulate the cross and buttons to make the character move appropriately. I chose standardized tests to measure these skills, trying to determine if more hours of interacting (playing) would increase the test scores. The study did not reach significance, but the children all scored in the upper percentiles on the tests. What happened?

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One explanation is that the pilot groups of these tests had not been exposed to playing with home video games, since the tests were conducted before 1980. So, maybe we need new tests? Another reason could be that the children of today, because of technology, are developing cognitive and psychomotor skills at an earlier age.

The second study moved on to the software and older children. High school students have been exposed to video games for approximately seven years. I thought that being successful with the software required certain skills, and that these students should be proficient at these skills. I analyzed many games, and found similar thinking skills. The hard part was finding a way to measure these skills. I finally found a critical thinking skills test (Cornell Critical Thinking Skills, Level X). The test was in a story format, and thus presented a new problem. If the students did well on the test, did it mean that they were able to transfer the skills acquired from playing a visual format into a reading format, or did it mean that they learned skills from video games that made them better readers, or did it mean that they were, indeed, just better readers? I convinced myself that this test was as close as I could get to measure these skills (observing, assuming, hypothesizing), and proceeded with the study. I divided the subjects up into a non-playing group (who did not watch TV/play for religious reasons), and a playing group. The results were not significant, but the playing group outscored the non-playing group in each of the five sub-skills that comprised the total skill of critical thinking.

On with the third study. I had studied every group of students (4th, 5th, 6th grades, and high school students), except for the 7th and 8th grades. I was anxious to see what these students were doing in their spare time for several reasons. One was to get a complete picture of playing time for all ages. (My other studies had obtained information from 9-12 and 14-18 year old children. I did not pursue younger children because I don't think they are cognitively developed enough to handle playing.) Another was to test my idea that video games do not incite violence. And yet another broader reason was to see how puberty affects children's habits. I also had many small areas of interest. (e.g., I needed to find out how much time children were watching TV, if grades were effected, if a certain type of person played more or less, etc.)

The big finding of this study was that children do not think violent thoughts while playing. I had theorized that they were worrying about the next move, the next board, and how they can win, and thus not thinking about killing and destroying. Every student indicated that they **were not thinking violent thoughts, but were thinking of the strategy of the game.** (In a previous study, I looked at feelings and thoughts before, during, and after playing, and found out that children used these games to

work through anger, sadness, and to have a good time.) Another interesting result is that as they grow older, particularly at the age span of 12-14, **children' s involvement in this activity lessens.** When children are 9-12, they play about 17 hours per week, it decreases to 5-7 hours at the ages of 12-14, and increases to about 10 hours per week, at the ages of 15-18.

How much time they devote to television viewing is astonishing. These hours of viewing ranged from **10-27 hours per week**. My studies indicates that **television viewing time does not decrease at any age.** As an aside, children are playing sports, talking on the phone, interacting with peers, and even reading non-required material in their leisure time.

Sales of home entertainment systems have not decreased. According to sales figures, Nintendo invaded over 30 million homes in the U.S. from 1986-1988. Sales were at 9 million in 1989; 7.2 million in 1990; 4.5 million in 1991 with the Super Nintendo selling an additional 2.2 million; and in 1992 4.8 billion. In 1991, Nintendo supplanted Toyota as Japan's No. 1 company. It netted a billion dollars. The NES (nintendo Entertainment System) has made more money for it's stockholders in the last three years than any company traded on the Japanese stock exchange, and has outsold Sony, Japan's leading company, as well as MicroSoft, America's leading figure.

These figures cannot be ignored. I think that research such as mine, that is often scoffed at, must continue. It is imperative that we, as educators, get involved with this important aspect of children's lives.

As a result of investigating the literature for five years, conducting studies with 498 students, and sharing this experience with my children over the course of many years, my general conclusions are that interacting with home video game systems is not harmful, may be beneficial, and does not incite violence. As an aside, I strongly urge parents to monitor their children's playing time, to ensure that they are not playing excessively, and not to worry because as they get older, playing time will decrease.

In the future, I plan to examine very young children (ages 4-6) to determine whether playing is helpful, or too frustrating. In the long run, I would like to look at the developmental stages of children to see if a reassessment of skills at a certain stage or age needs to be conducted.

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Children and the Nintendo Entertainment System

Suzanne M. Keller*

Abstract

This paper discusses the beneficial and harmful effects when children play with the Nintendo Entertainment System.

Introduction

The Nintendo Entertainment System (NES) was first introduced into the electronic and toy markets in 1986. Sales in 1988 were approximated at 15 million (ref 1). The figures for 1990 approached 30 million (ref 2). These figures do not include sales of the game cartridges required for playing, or any of the optional accessories. Two factors support the idea that interaction with this system is not just a passing fad. One factor is the number of systems sold. Consumers have been buying and continue to buy the NES since its inception in 1986 as the increase in sales figures demonstrates. The second factor is the number of years the product has been on the market. Interest has been maintained and heightened since the introduction of the NES in 1986, as the continued growth of the system and software from 1986-1990 indicate.

What is the NES?

The NES is a home video game system encased in a plastic box that attaches to a television set. It contains an eight-bit microprocessor chip for its central processing unit, a waveform generator for sound effects, and direct-memory access circuits for rapidly updating the screen. A custom picture processor supplements the system and it employs bank switching to address a large video memory area. (ref 3) Central to the operation of the system is a control panel. The control panel contains a cross which is manipulatable in four directions; two round buttons on the right side which operate in conjunction with the cross; and two elliptical buttons in the middle which start and stop games or select certain options in the games.

Why is the NES so appealing to children?

Children don't have control over many parts of their lives. Parents' rules dictate how they must behave at home and school rules mandate their behavior at school. They really don't have much freedom to express their feelings. Teachers expect the "correct" answer. Even in their peer group, there is a limit to what can be said and done without being ostracized. With the NES, children can control the characters' actions, the length of play, and how well they play. The characters can't respond in any way. The children can simply turn off the game whenever they don't like what's happening. When they lose they can try again and again, which is vastly different than a test in school where there is only one chance to make the grade. With continued practice and experimentation, they uncover "keys" or "secrets" which enable them to get further along in the game. The games are challenging enough to motivate them to try different strategies to gain advancement.

What are the possible benefits of interacting with the NES and the games?

Emotional

Unlike a bad grade, or a punishment, there are no consequences when losing a game. When a player loses the game, the game simply ends. There are an unlimited number of times a game can be played, even after it has been won. Each new effort at play results in a pay-off because each new attempt enables the player to get closer to winning. Each little success helps to build self-esteem and a real sense of accomplishment.

A player can work through feelings. If the player is feeling lonely or sad, he or she can get absorbed in the game, and escape from those feelings for a while. When anger is felt, it can be expressed by making the character punch or kick. Some of the games require fighting or some other form of violence. But, that violence does not carry over into real life situations. A player can assume the identity of the character, express the anger through the character, and thus lose the hostility they originally felt. In many situations, children don't have outlets for their feelings, and so they carry "emotional baggage" around. This "baggage" sometimes has funny ways of escaping. The games seem to provide an outlet for that unloading.

Social

Many children own a NES, making it an excellent topic for conversation. Discussion of numerous aspects of the games and of the many accessories that can be added, can be used to start new friendships and to maintain current ones. If a child has a new game, or even just a new "secret" for advancing in one of the games, that child can be the center of attention.

Children like to play the games together. Some games allow for as many as four players. Even the games that allow only one player to participate draw children together. They are great watcher

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boys secretly hope the current player won't get further than they already have, or that they will learn a new "secret" from watching another person play. The girls seem to gang up against the game, hoping to help the player conquer the game.

Because the system is contained in the home and not in an arcade or corner store, the fears connected with the social crowd have been eliminated. The constant flow of quarters to keep the game in operation is no longer needed, once the system has been purchased and placed in the home.

Educational

The interaction with the control panel (hardware) requires many of the same skills necessary for success in school. The key word is "interaction" as manipulating the pieces of the control panel requires both psychomotor and cognitive interactions. Eye-hand coordination, lateral awareness, and a sense of directionality are all required for manipulation of the various components of the control panel. These skills are used in the classroom in reading, writing, performing mathematical computations, and in map reading. (ref 4)

There are many games available, but the key ingredient for success seems to be thinking skills or higher level cognitive skills that aren't taught on a regular basis in school. Some of the higher level cognitive skills exercised are analysis, synthesis, and evaluation. Some of the processes involved are decision-making and problem solving. The goal of any educational system is to teach children how to think and make good decisions when faced with any situation, either in their personal life or in educational experiences. The games require these skills. The underlying question is whether children are extracting these skills and applying them to other areas of the curriculum.

What harmful effects come from interaction with the NES?

Without parental supervision, children will spend a great deal of time playing with the games. The playing time needs to be limited to three hours per day at a maximum. These three hours should be on a week-end, holiday, or during summer vacation. Over three hours of exposure can cause eye strain, but that eye strain does not last (ref 5). During school days, playing should be limited to one hour per night, and this should come only after homework, chores, and other responsibilities.

Domination of the system and the television set can cause problems with siblings or parents.

Game purchase without prior evaluation can cause real problems especially if the game is inappropriate, too violent, or not challenging. Most games can be rented from a video tape rental store at a very reasonable price, so parents can get an idea of the content of the game before purchase. The games are relatively expensive, therefore prior evaluation before purchase is economically wise.

Children feel a desperate need to buy many of the accessories, but the basic system provides plenty of enjoyment without any extra additions.

Parents should not use the system as a baby-sitter. Other activities should be encouraged, such as reading, listening to music, and physical activities. Children should be encouraged to be responsible about their own playing time.

Summary

The NES has dominated the toy market for the last four years, and continues to be a favorite pastime today. Children's obsession with the games should no longer be ignored or merely the subject of informal discussion among those of us connected in any way with children. Research with this interactive technology has begun, (ref 4) but much more needs to be conducted. The system has enormous potential for the future, as word processing and control for as many as seven audio or visual peripherals are inherent in the system. Currently the NES occupies a place only in the leisure time area of children's lives, but even in this area, children are not passively absorbing mindless activity. The system and the games are developing skills and are, at the same time, fun. Whether educational activities can or should be fun, and children can enjoy learning from those activities, is an age old question that has yet to be answered definitively.

Society's reaction to the NES overwhelmingly indicates a need for serious examination of the NES. Any pastime that is not just a passing fad, occupies so much of children's time, and carries strong opinions from the public with it, needs to be explored seriously in the academic world.

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